

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 June 2004 (03.06.2004)

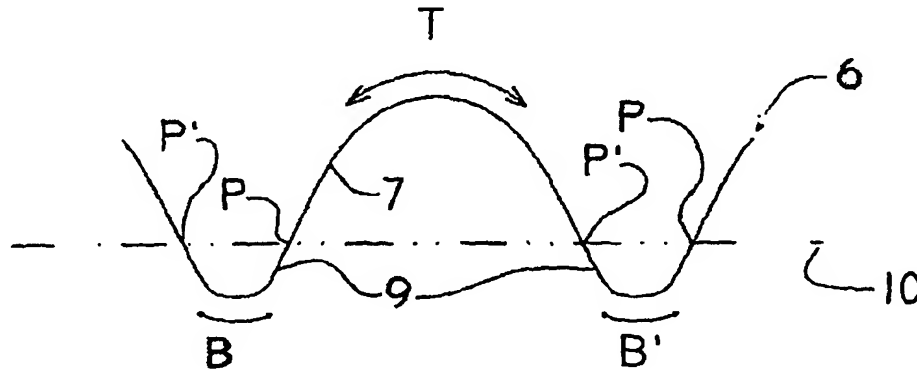
PCT

(10) International Publication Number
WO 2004/046594 A3

- (51) International Patent Classification⁷: **F16L 11/15** (74) Agent: BLEUKX CONSULTANCY BVBA; Rijksweg 237, 3650 Dilsen-Stokkem (BE).
- (21) International Application Number: PCT/EP2003/013044 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SK, SL, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 17 November 2003 (17.11.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 20025536 18 November 2002 (18.11.2002) NO
- (71) Applicant (*for all designated States except US*): NORSK HYDRO ASA [NO/NO]; Bygdøy Allé 2, N-0240 Oslo (NO).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): PETERSEN, Henry [DK/DE]; Burgstrasse 9, 24939 Flensburg (DE). OLSEN, Søren, B. [DK/DE]; Margarethenstrasse 10, 3, 24939 Flensburg (DE). NIELSEN, Karl, Brian [DK/DK]; Trekanten 8, DK-9270 Klarup (DK).
- (84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
- with international search report
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: A FLEXIBLE, TUBULAR DEVICE E.G. A BELLOWS



(57) Abstract: The present invention concerns a flexible, tubular device e.g. a bellows with an internal diameter up to 60 millimeters, said device comprising one or more corrugated convolutions (2), said convolutions having an overall bell-like shape with rounded top portions (T) and rounded bottom portions (B,B'). The novel aspects involve that the curvature of the outside surface of the convolutions (2) is numerically smaller at the top portions (T) than at the bottom portions (B,B'), said curvature being derived from a curve (6) defined as the intersection of the outside surface (4) of the device and a plane through the longitudinal axis (8) of the device, as well as they involve that the curvature of said curve changes sign only once at a change position (P,P') located between a top portion (T) and an adjacent bottom portion (B,B'), and that the length of a first section (7) on the curve (6) is at least 10% longer than the length of a second section (9) on the curve, said first section (7) extending from one change position (P) to an adjacent change position (P) via a top portion (T), and said second section (9) extending from one change position (P) to an adjacent change position (P') via a bottom portion (B,B'). This provides an improved design with increased durability due to increased flexibility at lower stresses, compared to the prior art.



(88) Date of publication of the international search report:
5 August 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/13044

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F16L11/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 803 132 A (LUPKE MANFRED A A) 8 September 1998 (1998-09-08) figure 6 ---	1-12
X	US 3 561 492 A (KAUDER KNUT ET AL) 9 February 1971 (1971-02-09) figure ---	1-12
X	US 6 006 788 A (JUNG PATRICE JOEL LOUIS ET AL) 28 December 1999 (1999-12-28) column 2, line 41 - line 45; figure 4 ---	1-12
X	DE 26 20 718 A (SEMPERIT GMBH) 6 October 1977 (1977-10-06) page 4 last paragraph figure --- -/--	1-12

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the International filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

27 May 2004

Date of mailing of the international search report

15 JUN 2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

JENNY PETERSSON/JAA

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/13044

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 4 246 937 A (MUELLER HANS R) 27 January 1981 (1981-01-27) figure 1</p> <p>-----</p>	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 03/13044

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5803132	A	08-09-1998	US 5542834 A CA 2162622 A1	06-08-1996 11-05-1996
US 3561492	A	09-02-1971	AT 301284 B BE 716179 A CH 468583 A DE 1600503 A1 FR 1567743 A GB 1186122 A IE 32104 B1 JP 52006766 B NL 6807601 A ,B	25-08-1972 04-11-1968 15-02-1969 02-04-1970 16-05-1969 02-04-1970 18-04-1973 24-02-1977 09-12-1968
US 6006788	A	28-12-1999	FR 2756605 A1 AT 214796 T AU 722738 B2 AU 7398198 A BR 9707344 A CA 2245738 A1 DE 69711167 D1 DK 877887 T3 EP 0877887 A1 WO 9825063 A1 JP 2000504404 T NO 983562 A	05-06-1998 15-04-2002 10-08-2000 29-06-1998 20-07-1999 11-06-1998 25-04-2002 05-08-2002 18-11-1998 11-06-1998 11-04-2000 03-08-1998
DE 2620718	A	06-10-1977	CH 601715 A5 DE 2620718 A1 DE 7614853 U1	14-07-1978 06-10-1977 26-10-1978
US 4246937	A	27-01-1981	CH 629266 A5 DE 2854419 A1 FR 2412643 A1 GB 2011972 A ,B JP 1358922 C JP 54088343 A JP 61020680 B NO 784282 A ,B, SE 431476 B SE 7812888 A	15-04-1982 11-10-1979 20-07-1979 18-07-1979 13-01-1987 13-07-1979 23-05-1986 22-06-1979 06-02-1984 22-06-1979